

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion- and sedimentation-control measures.

1.2 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain FAA's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
  2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

#### 1.5 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at the project site (Ft. Lauderdale Executive Airport) located at 23<sup>rd</sup> Avenue in Fort Lauderdale, FL 33309.

#### 1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from FAA and authorities having jurisdiction.
  2. Provide alternate routes around closed or obstructed traffic ways if required by FAA or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining FAA's property will be obtained by FAA before award of Contract.
1. Do not proceed with work on adjoining property until directed by FAA RE.
- C. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- E. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
  2. Parking vehicles or equipment.
  3. Foot traffic.
  4. Erection of sheds or structures.
  5. Impoundment of water.
  6. Excavation or other digging unless otherwise indicated.
  7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- F. Do not direct vehicle or equipment exhaust towards protection zones.
- G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.



- H. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.
- I. Approximate locations of gopher tortoises and burrowing owl holes shown are from the time of the original survey. The plan may not accurately show the current locations. contractor shall inspect property for evidence of gopher tortoises and burrowing owls by contacting an "authorized gopher tortoises agent" for the surveying, trapping, marking, relocating tortoises and relocating gopher tortoise commensals and apply the proper 25-foot non-disturbance buffers at each burrow found until such time as they can be relocated. Contractor shall apply for a Gopher Tortoise / Burrowing Owl Relocation Permit from the Florida Fish and Wildlife Conservation Commission.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "EARTH MOVING."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground and install tree protection fence at drip line. Locate and clearly identify Gopher Tortoises and Burrowing Owls habitat locations and remain in compliance with the State regulations until proper permitting has been established.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to FAA.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by FAA RE.

### 3.4 EXISTING UTILITIES

- A. Contractor will coordinate with FAA Resident Engineer (RE) and arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
  - 1. Arrange with utility companies to shut off indicated utilities.
  - 2. FAA will arrange to shut off indicated utilities when requested by Contractor.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by FAA or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify FAA RE not less than two (2) days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without FAA RE's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.

### 3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
  - 3. Use only hand methods for grubbing within protection zones.
  - 4. Chip removed tree branches and stockpile in areas approved by FAA RE.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.



1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

### 3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
  1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
  1. Limit height of topsoil stockpiles to 72 inches.
  2. Do not stockpile topsoil within protection zones.
  3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
  4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

### 3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### 3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off FAA's property.
- B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

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SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing sub-grades for slabs-on-grade, walks, pavements, turf and grasses and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Sub-base course for concrete walks and pavements.
5. Sub-base course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 UNIT PRICES

A. Excavation is unclassified.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the sub-base course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated sub-grade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above sub-grade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions as directed by FAA RE.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions without direction by FAA RE. Unauthorized excavation, as well as remedial work directed by FAA RE, shall be without additional compensation.

- G. Fill: Soil materials used to raise existing grades.
  - H. Rock: Rock material in beds, ledges, un-stratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or ripping, when permitted:
    - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
    - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
  - I. Rock: Rock material in beds, ledges, un-stratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.
  - J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
  - K. Sub-base Course: Aggregate layer placed between the sub-grade and base course for hot-mix asphalt pavement, or aggregate layer placed between the sub-grade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
  - L. Sub-grade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, drainage course, or topsoil materials.
  - M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- 1.4 SUBMITTALS
- A. Product Data: For each type of the following manufactured products required:
    - 1. Geotextiles.
    - 2. Geofoam.
    - 3. Warning tapes.
  - B. Qualification Data: For qualified testing agency.
  - C. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
    - 1. Classification according to ASTM D 2487.
    - 2. Laboratory compaction curve according to ASTM D 698.



- D. Blasting is not permitted.
- E. Seismic survey report from seismic survey agency.
- F. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

#### 1.5 QUALITY ASSURANCE

- A. Blasting: Not permitted.
- B. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- C. Pre-excavation Conference: Conduct conference at project site.

#### 1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from FAA and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by FAA or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining FAA's property will be obtained by FAA before award of Contract.
  - 1. Do not proceed with work on adjoining property until directed by FAA RE.
- C. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth moving operations.
- D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section "SITE CLEARING," are in place.
- E. Do not commence earth moving operations until plant-protection measures are in place.
- F. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, a combination of these groups or in accordance with a Geotechnical Report for the site; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, a combination of these groups or in accordance with a Geotechnical Report for the site.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Sub-base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve or in accordance with a Geotechnical Report for the site.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate.



- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
4. Tear Strength: 56 lbf; ASTM D 4533.
5. Puncture Strength: 56 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

## 2.3 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect sub-grades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared sub-grades, and from flooding Project site and surrounding area.
- B. Protect sub-grades from softening, undermining, washout, and damage by rain or water accumulation.
  1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### 3.3 EXPLOSIVES

- A. Explosives: Not permitted.

### 3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to sub-grade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 12 inches outside of concrete forms other than at footings.
    - b. 12 inches outside of concrete forms at footings.
    - c. 6 inches outside of minimum required dimensions of concrete cast against grade.



- d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
- e. 6 inches beneath bottom of concrete slabs-on-grade.
- f. 6 inches beneath pipe in trenches, and the greater of 12 inches wider than pipe or 36 inches wide.
- g. Or in accordance with a Geotechnical Report for the site.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been installed, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
  - 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
  - 1. Excavate by hand to indicated lines, cross sections, elevations, and sub-grades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and sub-grades.

### 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
  - 1. Clearance: 6 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape sub-grade to provide continuous support for bells, joints, and barrels

of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench sub-grade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trenches in Tree- and Plant-Protection Zones:
1. Hand-excavate to indicated lines, cross sections, elevations, and sub-grades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

### 3.8 SUBGRADE INSPECTION

- A. Notify FAA RE when excavations have reached required sub-grade.
- B. If FAA RE determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll sub-grade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated sub-grades.
1. Completely proof-roll sub-grade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by FAA RE, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by FAA RE, without additional compensation.
- F. Review subgrade at pavement locations and verify grading will drain stormwater runoff as intended.

### 3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by FAA RE.
1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by FAA RE.



3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, sub-drainage, damp-proofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on sub-grades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on sub-grades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "CAST-IN-PLACE CONCRETE."
- D. Trenches under Roadways: Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway sub-base course. Concrete is specified in Section 03 30 00 "CAST-IN-PLACE CONCRETE."
- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.



- G. Place and compact final backfill of satisfactory soil to final sub-grade elevation.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below sub-grade under pavements and slabs.

### 3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on sub-grades free of mud, frost, snow, or ice.

### 3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 "Standard Proctor":
  - 1. Under structures, building slabs, steps, and pavements, scarify and re-compact top 12 inches of existing sub-grade and each layer of backfill or fill soil material at 98 percent.
  - 2. Under walkways, scarify and re-compact top 6 inches below sub-grade and compact each layer of backfill or fill soil material at 95 percent.
  - 3. Under turf or unpaved areas, scarify and re-compact top 6 inches below sub-grade and compact each layer of backfill or fill soil material at 90 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

### 3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  1. Provide a smooth transition between adjacent existing grades and new grades.
  2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish sub-grades to required elevations within the following tolerances:
  1. Turf or Unpaved Areas: Plus or minus 6 inches.
  2. Walks: Plus or minus 24 inches.
  3. Pavements: Plus or minus 4 inches.
- C. Grading inside Building Lines: Finish sub-grade to a tolerance of 1 inch when tested with a 10-foot straightedge.

### 3.17 SUB-BASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place sub-base course and base course on sub-grades free of mud, frost, snow, or ice.
- B. On prepared sub-grade, place sub-base course and base course under pavements and walks as follows:
  1. Install separation geotextile on prepared sub-grade according to manufacturer's written instructions, overlapping sides and ends.
  2. Place base course material over sub-base course under hot-mix asphalt pavement.
  3. Shape sub-base course to required crown elevations and cross-slope grades.
  4. Place sub-base course and base course 6 inches or less in compacted thickness in a single layer.
  5. Place sub-base course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  6. Compact sub-base course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 100 percent of maximum dry unit weight according to ASTM D 1557 "Modified Proctor".
- C. Pavement Shoulders: Place shoulders along edges of sub-base course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each sub-base and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557 "Modified Proctor".

### 3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on sub-grades free of mud, frost, snow, or ice.



- B. On prepared sub-grade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Install sub-drainage vapor barrier on prepared sub-grade according to manufacturer's written instructions, overlapping sides and ends.
  - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
  - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698 "Standard Proctor".

### 3.19 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
  - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  - 2. Determine that fill material and maximum lift thickness comply with requirements.
  - 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test sub-grades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Sub-grade: At footing sub-grades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing sub-grades may be based on a visual comparison of sub-grade with tested sub-grade when approved by FAA RE.
- E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved and Building Slab Areas: At sub-grade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
  - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- F. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by FAA RE; reshape and re-compact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Transport surplus satisfactory soil to designated storage areas on FAA's property. Stockpile or spread soil as directed by FAA RE or remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off FAA's property as directed by FAA RE.

END OF SECTION 31 20 00



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SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil and wood treatment with termiticide.
2. Bait-station system.
3. Metal mesh barrier system.
4. Polymer sheet barrier system with termiticide.
5. Polymer barrier fittings with termiticide for installation around utility penetrations.

1.2 UNIT PRICES

- A. Work of this Section is affected by unit price for additional polymer barrier fittings with termiticide at utility penetration(s).

1.3 SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA-Registered Label for termiticide products.

B. Qualification Data: For qualified Installer.

C. Product Certificates: For termite control products, from manufacturer.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for FAA's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

E. Wood Treatment Application Report: After application of termiticide is completed, submit report for FAA's records and include the following:

1. Date and time of application.
2. Termiticide brand name and manufacturer.
3. Quantity of undiluted termiticide used.
4. Dilutions, methods, volumes used, and rates of application.
5. Areas of application.



- F. Bait-Station System Application Report: After installation of bait-station system is completed, submit report for FAA's records and include the following:
  - 1. Location of areas and sites conducive to termite feeding and activity.
  - 2. Plan drawing showing number and locations of bait stations.
  - 3. Dated report for each monitoring and inspection occurrence indicating level of termite activity, procedure, and treatment applied before time of Substantial Completion.
  - 4. Termiticide brand name and manufacturer.
  - 5. Quantities of termiticide and nontoxic termite bait used.
  - 6. Schedule of inspections for one year from date of Substantial Completion.
- G. Polymer Sheet Barrier System with Termiticide Application Report: After installation of polymer sheet barrier system with termiticide is completed, submit report for FAA's records and include the following:
  - 1. Plan drawing showing extent of sheet barrier and number and locations of each type of polymer barrier fitting.
  - 2. Termiticide brand name and manufacturer.
  - 3. Schedule of inspections for one year from date of Substantial Completion.
- H. Polymer Barrier Fittings with Termiticide Application Report: After installation of polymer barrier fittings with termiticide is completed, submit report for FAA's records and include the following:
  - 1. Plan drawing showing number and locations of each type of polymer barrier fitting with termiticide.
  - 2. Termiticide brand name and manufacturer.
  - 3. Schedule of inspections for one year from date of Substantial Completion.
- I. Warranties: Sample of special warranties.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products from single source from single manufacturer.
- D. Pre-installation Conference: Conduct conference at project site.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- C. Apply wood treatment after framing, sheathing, and exterior weather protection is completed but before electrical and mechanical systems are installed.
- D. Install bait-station system after construction, including landscaping, is completed.
- E. Install polymer sheet barrier system with termiticide prior to placing concrete slab reinforcement and pouring concrete and after installation and inspection of footings, foundations, and plumbing and electrical pipes and conduits.
- F. Install polymer barrier fittings with termiticide around utility penetrations prior to pouring concrete and after installation and inspection of plumbing and electrical pipes and conduits, slab vapor barrier, and concrete slab reinforcement.

#### 1.6 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Wood Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied wood termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite damage is discovered during warranty period, repair or replace damage caused by termite infestation and treat replacement wood.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Polymer Sheet Barrier System with Termiticide Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of installation of polymer sheet barrier system with termiticide, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat and repair or replace damage caused by termite infestation.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- D. Polymer Barrier Fittings with Termiticide Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of installation of polymer barrier fittings with termiticide, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat and repair or replace damage caused by termite infestation.
  - 1. Warranty Period: Five years from date of Substantial Completion.



1.7 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Substantial Completion, provide 12 months continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Corporation, Agricultural Products; Termidor.
    - b. Bayer Environmental Science; Premise 75.
    - c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar and Prevail.
    - d. Syngenta; Demon TC, Prelude and Probuild TC.
  2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

2.2 WOOD TREATMENT

- A. Borate: Provide an EPA-Registered borate termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution for spray application and a gel solution for pressure injection, formulated to prevent termite infestation in wood. Provide quantity required for application at the label volume and rate for the maximum diffusible borate concentration allowed for each specific use, according to product's EPA-Registered Label.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Nisus Corp.; Bora-Care, Jecta and Tim-Bor.
    - b. NovaGuard Technologies, Inc.; Armor-Guard and Shell-Guard.

2.3 BAIT-STATION SYSTEM

- A. Provide bait stations based on the dimensions of building perimeter indicated on Drawings, according to manufacturer's EPA-Registered Label for product, manufacturer's written instructions, and the following:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. BASF Corporation, Agricultural Products; Subterfuge.
  - b. Dow AgroSciences LLC; Sentricon System.
  - c. Ensystex, Inc.; Exterra System.
  - d. FMC Corporation, Agricultural Products Group; First Line.
  - e. Whitmire Micro-Gen Research Laboratories, Inc.; Advance TBS.
2. No fewer than one bait station per 8 linear feet.
  3. No fewer than one cluster of bait stations per 20 linear feet, consisting of no fewer than three bait stations per cluster.

#### 2.4 METAL MESH BARRIER SYSTEM

- A. Stainless-Steel Mesh: 0.025-by-0.018-inch mesh of 0.08-inch- diameter, stainless-steel wire, Type 316.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Termimesh USA, Inc.; Termimesh System.

#### 2.5 POLYMER SHEET BARRIER SYSTEM

- A. Polymer Sheet: 16-mil- thick, multilayered, laminated, polymer sheet with lambda-cyhalothrin termiticide sealed between two outer polymer layers.
  1. Products: Subject to compliance with requirements, provide the following:
    - a. Syngenta; IMPASSE Termite System.

#### 2.6 POLYMER BARRIER FITTINGS

- A. Products: Subject to compliance with requirements, provide the following:
  1. Syngenta; IMPASSE Termite Blockers.
- B. Pipe/Conduit Fitting: Integral 2-1/2-inch- long polymer sleeve and 1-inch- wide circular flange with lambda-cyhalothrin termiticide sealed between two outer polymer layers; with fasteners.
- C. Tub Trap Fitting: Integral polymer boot and 23-by-23-inch flange with lambda-cyhalothrin termiticide sealed between two outer polymer layers; with fasteners.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.



- B. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

### 3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

### 3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
  - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
  - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
  - 3. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
  - 4. Masonry: Treat voids.
  - 5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

### 3.5 APPLYING WOOD TREATMENT

- A. Application: Mix wood treatment solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of borate, according to manufacturer's EPA-Registered Label, so that wood framing, sheathing, siding, and structural members subject to infestation receive treatment.
  - 1. Framing and Sheathing: Apply termiticide solution by spray to bare wood for complete coverage.
  - 2. Wood Members More Than 4 Inches Thick: Inject termiticide gel solution under pressure into holes of size and spacing required by manufacturer for treatment.
  - 3. Exterior Uncoated Wood Trim and Siding: Apply termiticide solution to bare wood siding. After 48 hours, apply a seal coat of paint as specified in Division 09 painting Sections.

### 3.6 INSTALLING BAIT-STATION SYSTEM

- A. Place bait stations according to the EPA-Registered Label for the product and manufacturer's written instructions, in the following areas that are conducive to termite feeding and activity:
  - 1. Conducive sites and locations indicated on Drawings.
  - 2. In and around infested trees and stumps.
  - 3. In mulch beds.
  - 4. Where wood directly contacts soil.
  - 5. Areas of high soil moisture.
  - 6. Near irrigation sprinkler heads.
  - 7. Each area where roof drainage system, including downspouts and scuppers, drains to soil.
  - 8. Along driplines of roof overhangs without gutters.
  - 9. Where condensate lines from mechanical equipment drip or drain to soil.
  - 10. At plumbing penetrations through ground-supported slabs.
  - 11. Other sites and locations as determined by licensed Installer.
- B. Inspect and service bait stations from time of their application until Substantial Completion unless extended by continuing service agreement, according to the EPA-Registered Label for product and manufacturer's written instructions for termite management system and bait products.
  - 1. Service Frequency: Inspect bait stations not less than once every three month(s).



3.7 INSTALLING METAL MESH BARRIER SYSTEM

- A. Install metal mesh barrier system where indicated to provide a continuous barrier to entry of subterranean termites according to manufacturer's written instructions.
  - 1. Fit mesh tightly around pipe or other penetrations, and terminate at slab and foundation perimeters.
  - 2. Install mesh under the perimeter of concrete slab edges and joints after vapor barrier and reinforcing steel are in place, and comply with manufacturer's written installation methods.
- B. Inspect annually for termite activity and effectiveness of metal mesh barrier system according to manufacturer's written instructions.

3.8 INSTALLING POLYMER SHEET BARRIER SYSTEM

- A. Install polymer sheet barrier system according to manufacturer's EPA-Registered Label to provide a complete and continuous barrier to entry of subterranean termites.
- B. Remove any pipe wrap material so that the polymer sheet barrier system and fittings can be applied directly to the pipe or conduit. After installing the barrier, reapply pipe wrap material both below and above the blocker to protect the pipe from contact with concrete.
- C. Install polymer barrier fittings around each utility pipe and conduit penetrating concrete slab according to the EPA-Registered Label for the product and manufacturer's written instructions.

3.9 INSTALLING POLYMER BARRIER FITTINGS

- A. Remove any pipe wrap material so that the polymer barrier fittings can be applied directly to the pipe or conduit. After installing the barrier, reapply pipe wrap material both below and above the blocker to protect the pipe from contact with concrete.
- B. Install polymer barrier fittings around each utility pipe and conduit penetrating concrete slab according to the EPA-Registered Label for the product and manufacturer's written instructions.

END OF SECTION 31 31 16

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes temporary excavation support and protection systems.

1.2 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
  - 1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
  - 4. Monitor vibrations, settlements, and movements.

1.3 SUBMITTALS

- A. Shop Drawings: For excavation support and protection system.
- B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at project site.
  - 1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
    - a. Geotechnical report.
    - b. Existing utilities and subsurface conditions.
    - c. Proposed excavations.
    - d. Proposed equipment.
    - e. Monitoring of excavation support and protection system.
    - f. Working area location and stability.
    - g. Coordination with waterproofing.
    - h. Abandonment or removal of excavation support and protection system.



## 1.5 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by FAA or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  - 1. Notify FAA RE no fewer than two days in advance of proposed interruption of utility.
  - 2. Do not proceed with interruption of utility without FAA RE's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. FAA will not be responsible for interpretations or conclusions drawn from the data.
  - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
  - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify FAA RE if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
  - 1. Corners: Roll-formed corner shape with continuous interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
- E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- F. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- G. Tiebacks: Steel bars, ASTM A 722/A 722M.

- H. Tiebacks: Steel strand, ASTM A 416/A 416M.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
  - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from FAA and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

#### 3.2 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

#### 3.3 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not



more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

### 3.4 TIEBACKS

- A. Tiebacks: Drill, install, grout, and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
  - 1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
  - 2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

### 3.5 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
  - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by FAA RE.
  - 2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
  - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.6 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
  - 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.
  - 2. Fill voids immediately with approved backfill compacted to density specified in Section 31 20 00 "EARTH MOVING."
  - 3. Repair or replace, as approved by FAA RE, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION 31 50 00

SECTION 31 63 29 – AUGER CAST PILES

PART 1 - GENERAL

1.1 REFERENCES

- A. ASTM C 31/C 31M (2009) Making and Curing Concrete Test Specimens in the Field
- B. ASTM C 33 (2008) Concrete Aggregates
- C. ASTM C 39 (2009) Compressive Strength of Cylindrical Concrete Specimens
- D. ASTM C 109/C 109M (2008) Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)
- E. ASTM C 150 (2009) Portland Cement
- F. ASTM C 618 (2008) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
- G. ASTM C 937 (2002) Grout Fluidifier for Preplaced-Aggregate Concrete
- H. ASTM C 939 (2002) Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
- I. ASTM D 1143 (2007) Piles Under Static Axial Compressive Load

1.2 UNIT PRICES BASIS FOR BIDS AND PAYMENTS

- A. Unit Price Basis of Payment - The RE reserves the right to increase or decrease the length of piles to be furnished and installed, to change the foundation pile locations or elevations, to require the installation of additional piles, or to require omission of piles from the requirements shown and specified. Whether or not such changes are made, the Contractor will be paid at the contract unit price per linear foot (including test piles), multiplied by the total linear feet of acceptable piles actually installed; provided however, that in the event the RE/Owner requires an increase or decrease in the total length of piles furnished and installed, the contract unit price will be adjusted in accordance with special contract requirements.
- B. Full Compensation - Payment in accordance with paragraph Unit Price Basis of Payment shall constitute full compensation for furnishing, delivering, handling, and/or installing (as applicable) all material, labor and equipment necessary to meet contract requirements applicable to the foundation piles. The Contractor will not be allowed payment for withdrawn, broken, or rejected piles, nor (except for control test piles) for a portion of any pile remaining above the cut-off point.
- C. Load Tests - The contract includes 2 pile load tests. The RE/Owner reserves the right to increase or decrease the number of pile load tests. Adjustments in the contract price will be made for such increases or decreases in the amount bid for "Each Additional Pile Load Test" or



"Each Omitted Pile Load Test."

### 1.3 SUBMITTALS

- A. Shop Drawings: Auger-placed Grout Piles; Drawings to demonstrate compliance of augering, mixing, and pumping equipment, and installation and installed piles with contract documents. Drawings shall include detail and erection details and reinforcement as specified. Test Piles; A complete and accurate record of all auger-placed grout piles (both test and production piles). The record shall indicate the pile location, diameter, length, elevation of tip and top of pile, and the quantity and strength of grout material actually pumped in each pile hole. Any unusual conditions encountered during pile installation shall be reported immediately to the RE/Owner.
- B. Product Data: Grout Pump; Materials; Grout Specimens for Laboratory Tests and Contractor Tests;
- C. A description of the materials to be used and the proposed methods of operations. Certificates: Auger-placed Grout Piles; Evidence to the RE/Owner that the Contractor has been engaged in the successful installation of auger-placed grout piles for at least 3 years.

## PART 2 - REQUIREMENTS

- 2.1 The ground surface at each pile location at the time of augering and grouting, shall be at least 300 mm (12 inches) higher than the required pile cut-off elevation and the augered hole shall be completely filled with grout. All materials shall be fed to the mixer accurately measured by weight, except water that may be measured by volume. The order of placing the materials shall be water, fluidifier, and other solids in order of increasing particle size. Time of mixing shall not be less than 1 minute.
- 2.2 Each pile hole shall be drilled and filled with grout in an uninterrupted operation, except where the auger withdrawal is required or directed by the RE/Owner. When the auger is withdrawn to check the soil profile, it shall be reinserted in the pile hole to the required tip elevation and the pile hole filled with grout, without interruption.
- 2.3 The minimum inside diameter of the hollow shaft of the auger flight shall be 1-1/4 inches. Grout injection equipment shall be provided with a grout pressure in clear view of the equipment operator. Rate of grout injection and rate of auger withdrawal from the soil shall be coordinated to maintain, at all times, a positive pressure on this gauge which will, in turn, indicate the existence of a "removing pressure" on the bottom of the auger flight. The magnitude of this pressure and performance of other augering and grouting procedures, such as rate of augering, rate of grout injection, and control of grout return around the auger flight are dependent on soil conditions and equipment capability and shall be at the option of the Contractor, subject to review by the RE/Owner. The auger hoisting equipment shall be capable of withdrawing the auger smoothly and at a constant rate. If the auger jumps upward during



withdrawal, it shall be reinserted to the original tip elevation and the rate of withdrawal decreased to prevent further jumping.

- 2.4 Material excavated by augering shall be disposed of by the Contractor outside the limits of the right-of-way, unless otherwise directed. No pile shall be left partially completed overnight but must be completely grouted and protected at the termination of each day's operation.
- 2.5 The grout pump shall be a positive displacement pump of an approved design. The pump discharge capacity shall be calibrated in strokes per cubic foot, or revolutions per cubic foot, by a method approved by the RE/Owner. Oil or other rust inhibitors shall be removed from the mixing drums and pressure grout pumps prior to mixing and pumping.

2.6 MATERIALS

- A. Grout shall consist of a mixture of portland cement, a pozzolanic material (when approved) fluidifier, sand, and water. This mixture will be proportioned and mixed to produce a grout capable of being pumped with an ultimate compressive strength of 5000 psi at 28 days. Other admixtures shall not be used.
- B. Portland cement shall be Type I conforming to ASTM C 150 with test piles being Type III.
- C. Pozzolan shall be a fly ash or other approved pozzolanic material conforming to ASTM C 618.
- D. Grout fluidifier shall conform to ASTM C 937, except that expansion shall not exceed 4 percent. The fluidifier shall be a compound possessing characteristics that will increase the flowability of the mixture, assist in the dispersal of cement grains, and neutralize the setting shrinkage of the high-strength cement mortar.
- E. Water shall be fresh, clean, and free from sewage, oil, acid, alkali, salts, or organic matter.
- F. Fine aggregate (To be used as alternate requirement.) shall meet the requirements of ASTM C 33. The sand shall consist of hard, dense, durable, uncoated rock particles and be free from injurious amounts of silt, loam, lumps, soft or flaky particles, shale, alkali, organic matter, mica, and other deleterious substances. If washed, a washing method shall be used that will not remove desirable fines, and the sand shall subsequently be permitted to drain until the residual-free moisture is reasonably uniform and stable. The sand shall be well-graded from fine to coarse, with fineness modulus between 1.30 and 3.40. The fineness modulus is defined as the total divided by 100 of the cumulative percentages retained on U.S. Standard Sieve Numbers 16, 30, 50, and 100.
- G. Aggregate – Shall meet the requirements of ASTM C 33, for fine aggregate, except as to grading. The sand shall consist of hard, dense, durable, uncoated rock fragments and shall be free from injurious amounts of silt, lumps, loam, soft, or flaky particles, shale, alkali, organic matter, mica, and other deleterious substances. If washed, the method shall not remove other desirable fines and the sand shall be permitted to drain until the residual free moisture is reasonably uniform and stable. Sand grading shall be reasonably consistent and shall conform to the following requirements as delivered to the grout mixer:



<u>U.S. Standard Sieve Number</u>	<u>Cumulative Percent By Weight Passing</u>	<u>Cumulative Percent By Weight Retained</u>
8	100	0
16	95-100	0-5
30	55-80	20-45
50	30-55	45-70
100	10-30	70-90
200	0-10	90-100

- H. The sand shall have a fineness modulus of not less than 1.30 and not more than 2.10. Sand grading shown above may be modified with the approval of the RE/Owner. Mortar test specimens made with the modified sand shall exhibit compressive strength equal to, or greater than, that exhibited by similar specimens made with sand meeting grading and other requirements shown above.
- I. Reinforcement – Materials, assembly, and placement of reinforcement shall conform to the requirements of Section 033000 CAST-IN-PLACE CONCRETE.

### PART 3 - EXECUTION

#### 3.1 GROUT VOLUME

The volume of grout per linear foot of pile shall be not less than the volume of grout per foot of test piles. All volume measurements shall be made in the presence of the RE/Owner.

- A. Casings: The Contractor may use steel cylinder casings as a soil retention liner as soil warrants. Casings shall be approved by the RE/Owner and shall be left in place and filled with grout. Casings shall be of sufficient strength and rigidity to withstand all installation stresses, to prevent distortion caused by placing adjacent piles, and to prevent collapse due to soil or hydrostatic pressure. The casing shall be rotated by the auger drive unit (weighted or jetted) to the required depth. After the casing is in place, the casing and hole shall be cleared of water, sediment, and debris prior to pouring the grout.
- B. Flow cone test: The quantity of water used shall produce a grout having a consistency of not less than 21 seconds, when tested with a flow cone in accordance with ASTM C 939.
- C. Grout specimens for laboratory test: Grout tests shall be conducted in accordance with ASTM C 109/C 109M in a laboratory, approved by the RE/Owner. Test specimens shall be prepared by pouring grout into 2 x 2 x 2 inch cube molds. Not less than 9 cubes shall be cast during each 8-hour shift. Three cubes shall be tested at 7 days; 3 at 28 days; and 3 at 90 days
- D. Test Piles.
  - 1. Placement: Test piles shall be of the type, and shall be placed in the manner, specified elsewhere in this section. The Government/Owner will use test pile and load test data in addition to test reports on soil samples to determine "calculated" pile tip elevations. Piles immediately adjacent to the test pile shall be placed after placing test pile and prior to load testing. Test piles that are located within the tolerances indicated for all piles and provide a safe design capacity as determined by the results of a satisfactory load test may



be used in the finished work. Test loads shall not be applied to the piles until the grout has obtained a minimum strength of 3000 psi.

2. Depth: For all test piles, the auger shall be withdrawn after reaching the "calculated" tip elevation and before grout is pumped. The RE/Owner will be present to check the soil conditions and shall have the right to increase the test pile length, if soil conditions warrant. In such cases, the RE/Owner may require additional auger withdrawals after drilling to the lower tip elevation. Such additional auger withdrawals shall be included in the total number of auger withdrawals made. The pile hole shall not be filled with grout until the RE/Owner has approved the final tip elevation.
3. Loading Test: ASTM D 1143 contains several requirements, which would not be considered applicable to routine pile load testing. Load tests shall be performed in accordance with ASTM D 1143 as follows:
  - a. Delete the requirement for pretest information;
  - b. Permit a recent calibration of the test jack, pressure gauge, etc., instead of requiring such calibration to be made immediately prior to the test;
  - c. Permit the use of test jacks, which are not equipped with spherical bearings;
  - d. Permit the wedges and not the loads to be adjusted so they remain loose as settlement occurs;
  - e. Permit the supports for beams to which dial gauges are attached to be a minimum distance of 1.5 m (5 feet) from the center of the test pile;
  - f. Specifically delete the optional requirement for incremental strain measurement;
  - g. Delete the requirement that the test load is to be removed upon reaching loads of 50 and 100 percent of the anticipated working load;
  - h. Delete the requirement that the load is to be reapplied to 200 percent of the working load after removal of the test loads;
  - i. Delete the requirement that the pile is to be tested to 300 percent of the anticipated working load.
  - j. The requirement of performing the load tests under the direct supervision of a registered professional engineer may be waived by the RE/Owner
  - k. The load tests at locations shown or directed shall be made on test piles placed to the tip elevation used for establishing lengths of piles for bidding, except as otherwise directed by the RE/Owner. Loading, testing, and recording of data shall be under the supervision of a registered professional engineer. The analysis of the load test data shall be performed by the registered professional engineer. The registered professional engineer shall be provided and paid by the Government/Owner. The installation of contract piles shall not proceed within each area of substantially different subsoil conditions until a satisfactory load test has been performed in that area.

### 3.2 ACCEPTANCE

Test piles shall be loaded to twice the design working load of 115 tons, unless failure occurs first. The safe design capacity of a test pile, as determined from the results of load tests, shall be the lesser of the two values computed according to the following:

- A. One-half the load that causes a net settlement after rebound of not more than 0.01 inch per ton of total test load.



- B. One-half the load that causes a gross settlement of not more than 1 inch, provided that the load settlement curve shows no sign of failure.
- C. Tolerances: Piles shall be located as shown on drawings or as otherwise directed by the RE/Owner. Piles shall be installed from the ground surface existing after general excavation work has been completed. The maximum variation of the center of any pile from the required location shall be 2 inches at the ground surface, and no pile shall be out-of-plumb by more than 2 percent. Piles damaged, mislocated, or out of alignment beyond the maximum tolerance shall be abandoned and additional piles shall be placed as directed.
- D. Test piles withdrawals: In addition to the test pile holes, the auger shall be withdrawn from the ground at 2 pile holes. Before pumping grout, the soil profile at the "calculated" pile tip elevation will be checked by the RE/Owner.
- E. Protection of Piles: The sequence of pile installation shall be such that adjacent piles show no evidence of disturbance. This evidence would appear as a drop in the grout surface. The load applied to the soil by the drilling equipment shall be far enough away from the pile being drilled to avoid compressing or shearing the soil, which may in turn, displace or squeeze-off the grout column. No piles shall be placed within 5 feet of adjacent piles until the grout in the existing piles has set for 3 days, unless otherwise directed by the RE/Owner.

### 3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
  - 1. Concrete.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Concrete Tests and Inspections: ACI 301.

END OF SECTION 31 63 29

## SECTION 32 12 16 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Asphalt surface treatments.
5. Pavement-marking paint.
6. Traffic-calming devices.

#### 1.2 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.

- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

- C. Qualification Data: For qualified manufacturer and Installer.

- D. Material Certificates: For each paving material, from manufacturer.

- E. Material Test Reports: For each paving material.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of State Department of Transportation for asphalt paving work.



1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- D. Pre-installation Conference: Conduct conference at project site.
1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
    - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
    - b. Review condition of sub-grade and preparatory work.
    - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
    - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
  - B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.
- 1.6 PROJECT CONDITIONS
- A. Environmental Limitations: Do not apply asphalt materials if sub-grade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
    1. Prime Coat: Minimum surface temperature of 60 deg F.
    2. Tack Coat: Minimum surface temperature of 60 deg F.
    3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
    4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
  - B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.

- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

## 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.
- C. Prime Coat: Asphalt emulsion prime coat complying with State DOT requirements.
- D. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- E. Fog Seal: ASTM D 977 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- F. Water: Potable.

## 2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073, Grade Nos. 2 or 3.
- C. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.
- D. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
  - 1. Color: White.
- E. Wheel Stops: Precast, air-entrained concrete, 3,000-psi minimum compressive strength, 5 inches high by 6 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
  - 1. Dowels: #5 Bar, 18-inch minimum length.



## 2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AIMS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."
  - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  - 2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
    - a. Base Course: 6 inch.
    - b. Surface Course: 2 inch.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that sub-grade is dry and in suitable condition to begin paving.
- B. Proof-roll sub-grade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated sub grades.
  - 1. Completely proof-roll sub-grade in one direction. Limit vehicle speed to 3 mph.
  - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by FAA RE, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

### 3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Re-compact existing unbound-aggregate base course to form new sub-grade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
  - 1. Pump hot under-sealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
  - 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Re-compact existing unbound-aggregate base course to form new sub-grade.

- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

### 3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
  - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
  - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
  - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
  - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

### 3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared sub-grade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared sub-grade or surface of compacted-aggregate base before applying paving materials.
  - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.



- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.5 PAVING GEOTEXTILE INSTALLATION

- A. Apply asphalt binder uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd..

### 3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt surface course in single lift.
  - 2. Spread mix at minimum temperature of 250 deg F.
  - 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
  - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
  - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered"

method according to AIMS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  1. Base Course: Plus or minus 1/2 inch.
  2. Surface Course: Plus 1/4 inch, no minus.



- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 1/4 inch.
  - 2. Surface Course: 1/8 inch.
  - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

### 3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with FAA RE.
- B. Allow paving to age for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  - 1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal..

### 3.11 WHEEL STOPS

- A. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

### 3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of un-compacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

- a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
  - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
- 1. Do not allow milled materials to accumulate on-site.

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SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Parking lots.
3. Walkways.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.3 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Qualification Data: For testing agency.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
1. Aggregates.
- E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
1. Cementitious materials.
  2. Steel reinforcement and reinforcement accessories.
  3. Fiber reinforcement.
  4. Admixtures.
  5. Curing compounds.
  6. Applied finish materials.
  7. Bonding agent or epoxy adhesive.
  8. Joint fillers.
- F. Field quality-control test reports.
- G. Minutes of preinstallation conference.



#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete producer.
    - d. Concrete pavement subcontractor.

#### 1.5 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
  1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

## 2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Epoxy-Coated Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel.
- C. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.
- D. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- E. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.
- F. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
  1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
  2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:



1. Portland Cement: ASTM C 150, Type II, gray. Supplement with the following:
  - a. Fly Ash: ASTM C 618, Class C or F.
  - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source.
  1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

## 2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
  1. Products:
    - a. Monofilament Fibers:
      - 1) Axim Concrete Technologies; Fibrasol IIP.
      - 2) Euclid Chemical Company (The); Fiberstrand 100.
      - 3) FORTA Corporation; Forta Mono.
      - 4) Grace, W. R. & Co.--Conn.; Grace MicroFiber.
      - 5) Metalcrete Industries; Polystrand 1000.
      - 6) SI Concrete Systems; Fibermix Stealth.
    - b. Fibrillated Fibers:
      - 1) Axim Concrete Technologies; Fibrasol F.
      - 2) FORTA Corporation; Forta.
      - 3) Euclid Chemical Company (The); Fiberstrand F.
      - 4) Grace, W. R. & Co.--Conn.; Grace Fibers.
      - 5) SI Concrete Systems; Fibermesh.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Products:

- a. Axim Concrete Technologies; Cimfilm.
- b. Burke by Edeco; BurkeFilm.
- c. ChemMasters; Spray-Film.
- d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
- e. Dayton Superior Corporation; Sure Film.
- f. Euclid Chemical Company (The); Eucobar.
- g. Kaufman Products, Inc.; Vapor Aid.
- h. Lambert Corporation; Lambco Skin.
- i. L&M Construction Chemicals, Inc.; E-Con.
- j. MBT Protection and Repair, ChemRex Inc.; Confilm.
- k. Meadows, W. R., Inc.; Sealtight Evapre.
- l. Metalcrete Industries; Waterhold.
- m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
- n. Sika Corporation, Inc.; SikaFilm.
- o. Symons Corporation; Finishing Aid.
- p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
- b. Burke by Edoko; Aqua Resin Cure.
- c. ChemMasters; Safe-Cure Clear.
- d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
- f. Euclid Chemical Company (The); Kurez DR VOX.
- g. Kaufman Products, Inc.; Thinfilm 420.
- h. Lambert Corporation; Aqua Kure-Clear.
- i. L&M Construction Chemicals, Inc.; L&M Cure R.
- j. Meadows, W. R., Inc.; 1100 Clear.
- k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
- l. Symons Corporation; Resi-Chem Clear.
- m. Tamms Industries Inc.; Horncure WB 30.
- n. Unitex; Hydro Cure 309.
- o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.



F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

1. Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
- b. Burke by Edoco; Resin Emulsion White.
- c. ChemMasters; Safe-Cure 2000.
- d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
- f. Euclid Chemical Company (The); Kurez VOX White Pigmented.
- g. Kaufman Products, Inc.; Thinfilm 450.
- h. Lambert Corporation; Aqua Kure-White.
- i. L&M Construction Chemicals, Inc.; L&M Cure R-2.
- j. Meadows, W. R., Inc.; 1200-White.
- k. Symons Corporation; Resi-Chem White.
- l. Tamms Industries, Inc.; Horncure 200-W.
- m. Unitex; Hydro White.
- n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:
  1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products:

- a. Burke by Edeco; True Etch Surface Retarder.
- b. ChemMasters; Exposee.
- c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
- d. Euclid Chemical Company (The); Surface Retarder S.
- e. Kaufman Products, Inc.; Expose.
- f. Metalcrete Industries; Surfard.
- g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
- h. Scofield, L. M. Company; Lithotex.
- i. Sika Corporation, Inc.; Rugasol-S.
- j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.

2.8 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes.
  - 1. Color: As indicated.

2.9 WHEEL STOPS

- A. Wheel Stops: Precast, air-entrained concrete, 3000-psi minimum compressive strength, 5 inches high by 6 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
  - 1. Dowels: Galvanized steel, #5 Bar, 18-inch minimum length.

2.10 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 4000 psi.
  - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
  - 3. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  - 1. Air Content: 4 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:
  - 1. Fly Ash or Pozzolan: 25 percent.
  - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
  - 3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.



## 2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
  - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
  - 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
  - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Section 31 20 00 "EARTH MOVING."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

### 3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

#### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

#### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
  - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
  - 2. Provide tie bars at sides of pavement strips where indicated.
  - 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
  - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
  - 1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
  - 2. Extend joint fillers full width and depth of joint.
  - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.



5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
  3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

### 3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.



1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
  1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by FAA RE.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
  1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- M. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  2. Do not use frozen materials or materials containing ice or snow.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
  1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.



### 3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
  - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
  - 3. Contractor to coordinate desired finish with FAA RE.

### 3.8 SPECIAL FINISHES

- A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in pavement surfaces as follows:
  - 1. Immediately after float finishing, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
  - 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
  - 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
  - 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- B. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions and as follows:
  - 1. Uniformly spread 40 lb/100 sq. ft. dampened slip-resistive aggregate over pavement surface in 2 applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
  - 2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over pavement surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
  - 3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
  - 4. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

### 3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions, before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
  - 1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.10 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
  - 1. Elevation: 1/4 inch.
  - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  - 3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
  - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
  - 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
  - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
  - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
  - 8. Joint Spacing: 3 inches.
  - 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
  - 10. Joint Width: Plus 1/8 inch, no minus.

### 3.11 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with FAA RE.



- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  - 1. Spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal..

### 3.12 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

### 3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
  - 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  - 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

- D. Test results shall be reported in writing to FAA RE, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by FAA RE but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by FAA RE.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

#### 3.14 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by FAA RE, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13



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SECTION 32 31 13 - CHAINLINK FENCES AND GATES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes the following:

1. Galvanized steel chain-link fabric.
2. Galvanized steel framework.
3. Barbed wire.
4. Gates.

B. Grounding: Fence and gates shall be grounded as indicated on Contract Drawings.

C. Related Work

Section 03 30 00 – CAST IN PLACE CONCRETE

Section 32 31 13.10 – SLIDE GATE OPERATOR

1.2 REFERENCES

A. American Society for Testing and Materials

1. A 121: Zinc-Coated (Galvanized) Steel Barbed Wire
2. A 123: Specifications for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
3. A 392: Zinc-Coated Steel Chain-Link Fence Fabric
4. B 117: Standard Test Method of Salt Spray (Fog) Testing
5. F 567: Standard Practice for Installation of Chain-Link Fence.
6. F 1083: Standard Specifications for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
7. F 1184: Standard Specification for Industrial and Commercial Horizontal Slide Gates.

B. Federal Specifications (FS)

1. RR-F-191: Fencing, Wire and Post, Metal (and Gates, Chain-Link Fabric, and Accessories

1.3 DEFINITIONS

A. CLFMI: Chain Link Fence Manufacturers Institute.

B. Zn-5-Al-MM Alloy: Zinc-5 percent aluminum-mischmetal alloy.



#### 1.4 SUBMITTALS

- A. Product Data: Material descriptions, construction details, dimensions of individual components and profiles, and finishes for the following:
  - 1. Fence and gate posts, rails, tension wire and fittings.
  - 2. Chain-link fabric, reinforcements, and attachments.
  - 3. Gates and hardware.
  - 4. Barbed wire.
- B. Shop Drawings: Show locations of fence, each gate, posts, rails, and tension wires and details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, elevations, sections, gate swing and other required installation and operational clearances, and details of post anchorage, footings and attachment and bracing.
  - 1. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
  - 2. Wiring Diagrams: Power and control wiring and access control features. Differentiate between manufacturer-installed and field-installed wiring and between components provided by gate operator manufacturer and those provided by others.
- C. Product Certificates: Signed by manufacturers of chain-link fences and gates certifying that products furnished comply with requirements.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Field Test Reports: Indicate and interpret test results for compliance of chain-link fence and gate grounding and bonding with performance requirements.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations for Chain-Link Fences and Gates: Obtain chain-link fences and primary personnel gates, including accessories, fittings and fastenings from a single source.

- C. Source Limitations for Gate Operators: Obtain primary vehicle gates, gate operators, accessories, fittings, fastenings and installation services for primary vehicle gates and operators from a single source.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. UL Standard: Provide gate operators that comply with UL 325 "Standards for Safety for Drapery, Gate, Louver and Window Operators."
- F. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators serving as a required means of access.

#### 1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify FAA RE not less than 2 days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without FAA RE's written permission.
- B. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to actual field conditions and existing structures and utilities. Verify dimensions by field measurements.

### PART 2 - PRODUCTS

#### 2.1 CHAIN-LINK FENCE FABRIC

- A. Steel Chain-Link Fence Fabric: Height indicated on Drawings. Provide fabric fabricated in one-piece widths for fencing.
  - 1. Zinc-Coated Fabric: Comply with ASTM A 392 Class 2 and FS: RR-R-191, Type I, with zinc coating applied to steel wire before weaving with the following minimum coating weight:
    - a. Not less than 2 oz. /sq. ft. of uncoated wire surface.
  - 2. Coat selvage ends of fabric that is metallic coated during the weaving process with manufacturer's standard clear protective coating.
- B. Selvage: Twisted and barbed finish at top and bottom selvage.

#### 2.2 INDUSTRIAL FENCE FRAMING



- A. Round Steel Pipe: Standard weight, Schedule 40, galvanized steel pipe complying with ASTM F 1083 and RR-F-191 for Class F steel fence.
  - 1. External and Internal Coating Type A consisting of not less than 1.8 oz/sq. ft. zinc.
- B. Terminal Posts: Standard weight, Schedule 40 galvanized steel pipe, size as indicated on Contract Drawings.
- C. Post Brace Rails: Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.
  - 1. Size as indicated on Contract Drawings.
- D. Extended Members: Extend end and corner posts above top of chain-link fabric 12 inches as required to attach barbed wire assemblies.

## 2.3 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
  - 1. Location: Extended along top and bottom of fence fabric.
- B. Galvanize, gage indicated on Drawings, coiled spring wire, provided within the bottom 4 inches of the fabric. Zinc coating shall weight 1.6 ounces per square foot minimum. Attach to fence fabric as indicated on Contract Drawings. Crimp rings tight to prevent noise. No loose or rattling equipment will be allowed.

## 2.4 GATES, GENERAL

- A. Gates for Class F Fence: Conform to FS-RR-F-191.
- B. Primary personnel gates shall be manually operated, self-closing, with provisions for exterior lock housing.
- C. Primary vehicle gates located at the Entrance shall be power operated and activated by an electronic access control system.
- D. Hinges: Provide large bearing surfaces for clamping in position. Hinges shall not twist or turn under action of the gate. Non-motorized gates shall be capable of being opened and closed easily by one person and shall be arranged so they may swing back parallel to the fence. Latches, stops and keepers shall be provided for gates, unless otherwise shown on drawings. Keepers shall consist of a substantial mechanical device for securing and supporting the gate in the full open position. Spring, forked or pig-ear latches shall be provided for gates, except as noted on drawings. Provide heavily galvanized steel hinge, latches, stops, and keepers.

## 2.5 INDUSTRIAL SWING GATES

- A. General: Comply with FS RR-F-191 for the following swing-gate (Sliding gates use ASTM F1184) types:
  - 1. Single pedestrian gate.
- B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings as indicated on Drawings.
- C. Frames and Bracing: Fabricate from round galvanized steel tubing with outside dimension and weight according to FS RR-F-191 for the following gate fabric height:
  - 1. Gate fabric height indicated on Drawings.
- D. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and minimum weight according to FS-RR-F-191 for the following gate characteristics:
  - 1. Gate fabric heights indicated on Drawings.
  - 2. Gate Opening Width: Over 12 feet but not over 30 feet.
- E. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame as indicated on Drawings as required to attach barbed wire assemblies.
- F. Hardware: Latches permitting operation from both sides of gate, locking devices assemblies and stops fabricated from galvanized steel. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

## 2.6 FITTINGS

- A. General: Provide fittings for a complete fence installation, including special fittings for corners.
- B. For steel fences, stretcher bar and tension wire bands or clamps shall be 11-gage (0.1205-inch diameter) minimum thickness galvanized pressed steel bands; ties for attaching fabric to line posts shall be equal to 6-gage (0.0162 inch diameter) galvanized steel wire; ties for attaching fabric to top and brace rails shall be equal to 9-gage (0.1483 inch diameter) galvanized steel wire; and hog rings shall be equal to 9-gage (0.143-inch diameter) galvanized steel wire, except that stretcher bar clamps, ties and hog rings may be of aluminum conforming to the requirements of FS – RR-F-191.
- C. Post and Line Caps: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide weathertight closure cap for each post.
  - 1. Provide line post caps with loop to receive tension wire.
- D. Stretcher Bars: Fabricate one piece lengths equal to full height of fabric with a minimum cross section of 1/4-inch by 3/4-inch. Provide one stretcher bar of each gate, end post, and two for each corner or pull post.



- E. Stretcher Bar Bands: Heavy pressed steel, spaced not over 14 inches on center to secure stretcher bars to end, corner, pull and gate posts. Bands shall be within 4 inches of the top and bottom of fence fabric.
- F. Barbed Wire Arms: Twelve-gage pressed steel increasing the height of the fence to as indicated on Contract Drawings. The arms shall extend 45 degrees from the horizontal. Arms shall be capable of withstanding without failure 250 pounds downward pull at the outermost end of the arm. Fasten wires to the arm slots of heavy pins. Arms shall match existing fencing in area.
  - 1. Type I, double slanted arm.
- G. Tie Wires, Clips, and Fasteners: Provide the following types:
  - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
    - a. Hot-Dip Galvanized Steel: Nine-gage wire; galvanized coating thickness matching coating thickness of chain-link fence fabric. Spaced at 14 inches o.c.

## 2.7 BARBED WIRE

- A. Twisted Aluminized Steel Barbed Wire: Comply with RR-F-191 for the following three-strand barbed wire:
  - 1. Standard Size and Construction: As indicated on Drawings.

## 2.8 CAST-IN-PLACE CONCRETE

- A. General: Comply with ACI 301 for cast-in-place concrete.
- B. Materials: Portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and potable water.
  - 1. Concrete Mixes: Normal-weight concrete, air entrained with not less than 4000-psi compressive strength (28 days), 3-inch slump, and 3/4-inch maximum size aggregate or in accordance with Specification Section 03 30 00 – Cast In Place Concrete, whichever is more stringent.

## 2.9 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to

erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior applications.

- C. Or as needed or directed by FAA RE.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
1. Do not begin installation before final grading is completed, unless otherwise permitted by FAA RE.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

#### 3.3 INSTALLATION, GENERAL

- A. General: Install chain-link fencing to comply with FS RR-F-191.
1. Install fencing on established boundary lines inside property line, or as indicated on the Drawings.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
1. Drill holes for post footings in firm, undisturbed or compacted soil. Holes shall have a diameter equal to 4 times the diameter of the post except where otherwise indicated on the drawings.
  2. Excavate hole depths approximately 3 inches deeper than post bottom with bottom of lineposts set not less than 36 inches in concrete base, except where otherwise indicated on the drawings.
- C. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil. Set terminal, line and gate operator-mounting posts in concrete footing. Protect portion of posts aboveground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.



1. Maximum spacing between line posts is 10 feet.
2. Set keepers, stops, sleeves, and other accessories into concrete as required.
3. All posts shall be able to pass a pull test when a force of 48 pounds is applied perpendicular to the fence at the top of the post. The post should not deflect more than 1 inch at the location where the force is applied.
4. Post tops shall be riveted or shall be spot-welded. No loose or rattling fittings will be allowed.
5. Concealed Concrete Footings: Stop footings 2 inches below grade to allow covering with surface material.

### 3.4 CHAIN-LINK FENCE INSTALLATION

- A. Terminal Posts: Locate terminal end, corner, and gate posts and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- B. Post Bracing Assemblies: Install according to FS RR-F-191, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
  1. Anchor posts shall be set at approximately 500-foot intervals and braced to the adjacent line posts. Posts shall be braced before the wire fencing is placed.
- C. Tension Wire: Install according to FS RR-F-191, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric.
  1. Top Tension Wire: Install tension wire through post cap loops.
  2. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same gage and type of wire.
- D. Top Rail: If indicated on drawings-Install according to FS RR-F-191, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.
- E. Intermediate Rails: If indicated on drawings-Install in one piece at post-height center span, spanning between posts, using fittings, special offset fittings, and accessories.
- F. Bottom Rails: If indicated on drawings-Install, spanning between posts, using fittings and accessories.
- G. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.



- H. Tension or Stretcher Bars: Provide two stretcher bars for each pull post. Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 14 inches o.c.
- I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric. Bend ends of wire to minimize hazard to individuals and clothing.
  - 1. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to braces 24 inches o.c.
- J. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.
- K. Barbed Wire: Install 3 strands of barbed wire parallel on each extension arm, on the exterior side of fence (away from the Government property), unless otherwise shown. Barbed wire support arms shall have a tight press-fit or shall be spot-welded to preclude surreptitious removal. At end and gate posts, barbed wire shall be wrapped once around the posts and clipped and the ends of the horizontal wires tied with a snug tight twist. Each longitudinal wire shall be stapled to each post with a clip designed for use with steel posts. No loose or rattling fittings will be allowed. Pull wire taut to ninety pounds of tension.

### 3.5 GATE INSTALLATION

- A. Install swing gate posts in accordance with ASTM F 567.
- B. Gate locations and sizes shown on Drawings. Fabric shall be attached to the side of the gate frame that will be away from the Government property when the gate is installed in the closed position. Fabric shall be securely attached to the gate frame at intervals not exceeding 15 inches. Attachment to the vertical members of the gate frame shall be made through stretcher bars.
- C. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- D. Hinges, latches, stops and keepers for Class "F" fence gates shall conform to the requirements of FS-RR-F-191. All latches shall be arranged for locking the gates in the closed position.
- E. Gates shall be hung on two hinges attached in such a manner that the gates cannot be lifted off. Gates for Class "F" fences shall be installed to swing opposite to the slope of the extension arms, and if a driveway passes through a gate at an angle, the gate shall be hung on the side giving the greatest clear opening. To insure positive latching, the leg of the gatepost of fences on which the latch is placed shall be in all cases installed at right angles to the line of the gate in its closed position.
- F. Non-motorized Gates: Stops shall be provided for holding gates in an open position. The stop for engaging the plunger-bar latch shall be set in concrete. Keepers shall be located to support the free end of the gate in the full open position.



3.6 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, and limit switches.
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Test controls and safeties. Remove damaged and malfunctioning units, replace with new units, and retest.
- C. Lubricate hardware, gate operator and other moving parts.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train FAA's personnel to adjust, operate, and maintain gates.
  - 1. Test and adjust operators and controls hardware, and other operable components. Replace damaged or malfunctioning operable components.
  - 2. Train FAA's personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

3.8 CLEANING

- A. The contractor shall clean the jobsite of excess materials; post hole excavations shall be scattered uniformly away from posts.

END OF SECTION 32 31 13

SECTION 32 31 13.10 - SLIDE GATE OPERATOR

PART 1 - GENERAL

1.1 INCLUDED IN THIS SECTION

- A. Pre-wired, self-contained, slide gate operator for horizontal sliding gates, including all selected attachments and accessory equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Fencing
- B. Cast-in-place concrete

1.3 SUBMITTALS

- A. Shop drawings: Submit shop drawings under the provisions of Section 01 33 00. Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the operator. Drawings shall also show the size and location of the concrete mounting pad. Underground electrical runs and inductive vehicle obstruction loop locations shall be shown on shop drawings.
- B. Installation instructions: Submit two copies of manufacturer's installation instructions for this specific project.
- C. Submit manufacturer's completed warranty registration form to FAA RE.
- D. Test reports:
  - 1. Submit affidavits from the manufacturer demonstrating that the gate mechanism has been tested to 200,000 cycles without breakdown.
  - 2. Each operator shall bear a label indicating that the operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.

1.4 QUALITY ASSURANCE

- A. Manufacturer: A company specializing in the manufacture of hydraulic gate operators of the type specified, with a minimum of ten years experience.
- B. Installer: A minimum of three years experience installing similar equipment, provide proof of attending factory technical training within previous three years, or obtain other significant manufacturer endorsement of technical aptitude, if required, during the submittal process.

1.5 CODES AND REGULATORY REQUIREMENTS



- A. Operators shall be built to UL 325 standards and be listed by a testing laboratory. Complete all electrical work according to local codes and National Electrical code. All fieldwork shall be performed in a neat and professional manner, completed to journeyman standards.
- B. Operator shall be provided with multiple external sensors capable of reversing the gate in either direction upon sensing an obstruction.
- C. Operator shall be listed for use in all UL 325 Usage Classes: I, II, III, and IV.

#### 1.6 PRODUCT DELIVERY AND STORAGE

- A. Store products upright in the original shipping containers, covered, ventilated and protected from all weather conditions.

#### 1.7 WARRANTY

- A. Provide a five-year limited warranty against all defects in materials or workmanship. Defective materials shall be replaced with comparable materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the owner.
  - 1. To ensure validation of warranty, return completed warranty registration form to manufacturer.

### PART 2 – PRODUCTS

#### 2.1 GATE OPERATORS

- A. HySecurity gate operator model SlideDriver 10 (222 SS ST) with Smart Touch Controller, or approved equal.

#### 2.2 OPERATION

- A. Operation shall be by means of a metal rail passing between a pair of hydraulically driven solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 1000 pounds. Gate panel velocity shall not be less than 1.0 feet per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly.
- B. Standard mechanical components shall include as a minimum:
  - 1. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed, 1-1/2" bronze bearing surface, acting on arm pivot pins. (item 2 below)
  - 2. Arm pivot pins: 3/4" diameter, stainless steel, with integral tabs for ease of removal.

3. Tension spring: 2-1/2" heavy duty, 800 pound capacity.
4. Tension adjustment: Finger tightened nut, not requiring the use of tools.
5. Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.
6. Limit switches: Fully adjustable, toggle types.
7. Electrical enclosure: Oversized, metal, NEMA 4X, with hinged lid gasketed for protection from intrusion of foreign objects, and providing ample space for the addition of accessories.
8. Chassis: 1/4" steel base plate, and 12 Ga. sides and back welded and ground smooth.
9. Cover: 16 Ga. sheet stainless steel, NEMA 4X. All joints welded.
10. Drive wheels: 6" Dia. metal hub with polyurethane tread.
11. Drive rail: Shall be extruded 6061 T6, not less than 1/8" thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.
12. Hydraulic hose: Shall be 1/4" synthetic, rated to 2750 PSI.
13. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.
14. Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.
15. Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range -40F to 167F degrees (-40C to 75C).
16. A zero to 2000-PSI pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.
17. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.

C. Minimum standard electrical components:

1. Pump motor: Shall be a 1 HP, 56C, TEFC, continuous duty motor, with a service factor of 1.15, or greater. Provide 480V/3 phase for FAA entrance/exit gates, and 208V/1 phase for FXE AOA gate. Verify requirements prior to ordering equipment.
  2. All components shall have overload protection.
  3. Controls: Smart Touch Controller Board with 256K of program memory containing:
    - a. inherent entrapment sensor;
    - b. built in "warn before operate" system;
    - c. built in timer to close;
    - d. liquid crystal display for reporting of functions;
    - e. 26 programmable output relay options;
    - f. anti-tailgate mode;
    - g. built-in power surge/lightning strike protection;
    - h. menu configuration, event logging and system diagnostics easily accessible with a PC;
    - i. RS232 port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems or network interface.
  4. Transformer: 75 VA, non-jumpered taps, for all common voltages.
  5. Control circuit: 24VDC.
  6. Surge Arrestor: attached to incoming power conductors. Separate from controller board surge protection.
- D. Required external sensors: Photo eyes capable of reversing gate in either direction upon sensing an obstruction.



- E. Control devices: card reader, key-switch, pushbuttons, vehicle detectors, and keypads.
- F. Other:
  - 1. Lock for operator cover.
  - 2. Electric Solenoid gate panel deadbolt lock.
  - 3. Drive wheel manual release indicator switch.
  - 4. Weather-stripped drive rail slot in chassis.
  - 5. Through Beam or Reflective type photo eyes, open and close direction.
  - 6. Gate edge and transmitter radio reversing device.
  - 7. HY-5A plug in loop detectors.
  - 8. Key operated cable manual release (secure side of gate).
  - 9. Factory drive rail.

## 2.3 FACTORY TESTING

- A. Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity. Apply physical loads to the operator to simulate field conditions. Tests shall simulate physical and electrical loads equal to the fully rated capacity of the operator components.
- B. Check all mechanical connections for tightness and alignment. Check all welds for completeness and continuity. Check welded corners and edges to assure they are square and straight.
- C. Inspect painted finish for completeness. Touch up imperfections prior to shipment.
- D. Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

## PART 3 – EXECUTION

### 3.1 SITE EXAMINATION

- A. Locate concrete mounting pad in accordance with approved shop drawings.
- B. Make sure that gate is operating smoothly under manual conditions before installation of gate operators. Do not proceed until gate panel is aligned and operates without binding.

### 3.2 INSTALLATION

- A. Install gate operator in accordance with the manufacturer's printed instructions, current at the time of installation. Coordinate locations of operators with contract drawings, other trades and shop drawings.
- B. Installer shall insure that the electric service to the operator is at least 20 AMPS. Operator wattage is 1500.

### 3.3 FIELD QUALITY CONTROL

- A. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper "at rest" gate position.
- B. All anchor bolts shall be fully concealed in the finished installation.
- C. Owner, or owner's representative, shall complete "punch list" with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to manufacturer.

3.4 CONTINUED SERVICE AND DOCUMENTATION

- A. Train owner's personnel on how to safely shut off electrical power, release and manually operate the gate. Additionally, demonstrate the general maintenance of the gate operator and accessories and provide one copy of "Installation and Reference" manual for the owner's use. Manuals will identify parts of the equipment for future procurement.

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## SECTION 32 93 00 - PLANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Plants.
  - 2. Planting soils.
  - 3. Tree stabilization.
  - 4. Landscape edgings.

#### 1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- H. Finish Grade: Elevation of finished surface of planting soil.
- I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.



- J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- K. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- L. Planting Area: Areas to be planted.
- M. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- N. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- O. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- P. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- Q. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- R. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- S. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
  - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
  - 2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
  - 3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.



- B. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of FAAs' contact persons.
- C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
  - 1. Manufacturer's certified analysis of standard products.
  - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- D. Material Test Reports: For existing, in-place surface soil and imported or manufactured topsoil.
- E. Maintenance Instructions: Recommended procedures to be established by FAA for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- F. Warranty: Sample of special warranty.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
  - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  - 2. Experience: Three years' experience in landscape installation. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 3. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
    - a. Certified Landscape Technician - Exterior, with installation specialty area(s), designated CLT-Exterior.
    - b. Certified Landscape Technician - Interior, designated CLT-Interior.
    - c. Certified Ornamental Landscape Professional, designated COLP.
  - 4. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.
  - 1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.



2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from COTR/RE. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
  3. Report suitability of tested soil for plant growth.
    - a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
  - D. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
  - E. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
    1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
    2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
  - F. Plant Material Observation: COTR/RE may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. COTR/RE retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
    1. Notify COTR/RE of sources of planting materials seven days in advance of delivery to site.
  - G. Preinstallation Conference: Conduct conference at project site.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
  - B. Bulk Materials:
    1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.



2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
- C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
  2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
  3. Do not remove container-grown stock from containers before time of planting.
  4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by FAA or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
1. Notify Construction Manager no fewer than two days in advance of proposed interruption of each service or utility.
  2. Do not proceed with interruption of services or utilities without Construction Manager's written permission.
- C. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.



- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
  - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

#### 1.7 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by FAA, or incidents that are beyond Contractor's control.
    - b. Structural failures including plantings falling or blowing over.
    - c. Faulty performance of tree stabilization.
    - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Periods from Date of Planting Completion:
    - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
    - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
  - 3. Include the following remedial actions as a minimum:
    - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
    - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
    - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
    - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

#### 1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in PART 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
  - 1. Maintenance Period: 12 months from date of Final Acceptance.



- B. Initial Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
  - 1. Maintenance Period: 12 months from date of Final Acceptance.
- C. Continuing Maintenance Proposal: From Installer to FAA, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

## PART 2 - PRODUCTS

### 2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
  - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
  - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to COTR/RE, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.
- E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.



## 2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
  - 1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
  - 2. Provide lime in form of ground mollusk shells.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## 2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
  - 1. Organic Matter Content: 50 to 60 percent of dry weight.
  - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

## 2.4 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
  1. Size: 21-gram tablets.
  2. Nutrient Composition: 20 percent nitrogen, 20 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.
- F. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

## 2.5 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
  1. Type: Shredded hardwood, Ground or shredded bark, Wood and bark chips, Pine straw.
  2. Size Range: 3 inches maximum, 1/2 inch minimum.



3. Color: Natural.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
  1. Organic Matter Content: 50 to 60 percent of dry weight.
  2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

## 2.6 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

## 2.7 TREE STABILIZATION MATERIALS

- A. Stakes and Guys:
  1. Product standard of quality: DeepRoot; ArborTie7.
  2. Material: Flat, woven polypropylene; 900 lb. break strength.
  3. Size: 3/4" wide by manufacturer's standard roll lengths.
  4. Color: Green
- B. Palm Bracing: Battens or blocks, struts, straps, and protective padding as indicated.
  1. Battens or Blocks and Struts: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-4-inch nominal by lengths indicated.
  2. Straps: Adjustable steel or plastic package banding straps.
  3. Padding: Burlap.
  4. Proprietary Palm-Bracing Devices: Proprietary systems to secure each new planting by trunk; sized per manufacturer's written recommendations unless otherwise indicated.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Arborbrace; ArborBrace Palm Bracing.
      - 2) Horticultural Consultants, Inc.; Oasis Palm Tree Anchoring System.

## 2.8 MISCELLANEOUS PRODUCTS

- A. Wood Pressure-Preservative Treatment: AWPAC2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.
- B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- C. Burlap: Non-synthetic, biodegradable.
- D. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by COTR/RE and replace with new planting soil.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain COTR/RE's acceptance of layout before excavating or planting. Make minor adjustments as required.



- D. Lay out plants at locations as indicated in the drawings. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
  - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

### 3.3 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off FAA's property.
  - 1. Apply fertilizer directly to subgrade before loosening.
  - 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
    - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    - b. Mix lime with dry soil before mixing fertilizer.
  - 3. Spread planting soil to a depth of 4 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
    - a. Spread approximately one-half the thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, obtain COTR/RE's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Application of Mycorrhizal Fungi: At time directed by COTR/RE, broadcast dry product uniformly over prepared soil at application rate as determined by soil testing.

### 3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Leaving center area of bottom of tree pit raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.



1. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
  2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
  4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
  5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
  6. Maintain supervision of excavations during working hours.
  7. Keep excavations covered or otherwise protected overnight.
  8. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- B. Subsoil and topsoil removed from excavations may be used as planting soil.
- C. Obstructions: Notify COTR/RE if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
- D. Drainage: Notify COTR/RE if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.
- 3.5 TREE, SHRUB, AND VINE PLANTING
- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
1. Use planting soil for backfill.
  2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.



4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
  5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

### 3.6 MECHANIZED TREE SPADE PLANTING

- A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.
- B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.
- C. Cut exposed roots cleanly during transplanting operations.
- D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.
- E. Plant trees as shown on Drawings, following procedures in "Tree, Shrub, and Vine Planting" Article.
- F. Where possible, orient the tree in the same direction as in its original location.

### 3.7 TREE, SHRUB, AND VINE PRUNING

- A. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by COTR/RE, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- B. Do not apply pruning paint to wounds.

### 3.8 TREE STABILIZATION

- A. Staking and Guying: Stake and guy trees more than 14 feet in height and more than 3 inches in caliper unless otherwise indicated. Securely attach no fewer than three guys to stakes 30 inches long, driven to grade.
  1. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

- B. Palm Bracing: Install bracing system at three or more places equally spaced around perimeter of trunk to secure each palm until established unless otherwise indicated.

1. Site-Fabricated Palm-Bracing Method:

- a. Place battens over padding and secure battens in place around trunk perimeter with at least two straps, tightened to prevent displacement. Ensure that straps do not contact trunk.
- b. Place diagonal braces and cut to length. Secure upper ends of diagonal braces with galvanized nails into battens or into nail-attached blocks on battens. Do not drive nails, screws, or other securing devices into palm trunk; do not penetrate palm trunk in any fashion. Secure lower ends of diagonal braces with stakes driven into ground to prevent outward slippage of braces.

2. Proprietary Palm-Bracing Device: Install palm-bracing system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.9 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.10 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.11 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate



applications with FAA's operations and others in proximity to the Work. Notify FAA before each application is performed.

- B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

### 3.12 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

### 3.13 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off FAA's property.

END OF SECTION 32 93 00

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings
2. Nonpressure transition couplings
3. Expansion joints and deflection fittings
4. Cleanouts
5. Drains
6. Encasement for piping
7. Manholes
8. Channel drainage systems
9. Pipe outlets

1.2 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
1. Manholes: Include plans, elevations, sections, details, frames, and covers.
  2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
- C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- D. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.



1.5 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by FAA or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify FAA RE no fewer than two days in advance of proposed interruption of service.
  2. Do not proceed with interruption of service without FAA RE's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Cellular-Core Piping:
1. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
  2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.
- B. PVC Type PSM Sewer Piping:
1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
  2. Fittings: ASTM D 3034, PVC with bell ends.
  3. Gaskets: ASTM F 477, elastomeric seals.

2.2 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.3 CLEANOUTS

- A. Cast-Iron Cleanouts:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
  3. Top-Loading Classification(s): Medium Duty.

4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

## 2.4 DRAINS

### A. Cast-Iron Area Drains:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Description: ASME A112.6.3 gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
3. Top-Loading Classification(s): Medium and Heavy Duty.

## 2.5 MANHOLES

### A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

### B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.



## 2.6 CONCRETE

- A. General: Cast-in-place concrete according to Section 03 30 00 Cast In Place Concrete, ACI 318, ACI 350/350R, and the following:
  - 1. Cement: ASTM C 150, Type II.
  - 2. Fine Aggregate: ASTM C 33, sand.
  - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
  - 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
  - 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
  - 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
  - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    - a. Invert Slope: 1 percent through manhole.
  - 2. Benches: Concrete, sloped to drain into channel.
    - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
  - 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
  - 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

## 2.7 PIPE OUTLETS

- A. Mitered Slope: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
  - 1. Average Size: NSSGA No. R-3, screen opening 2 inches.
  - 2. Average Size: NSSGA No. R-4, screen opening 3 inches.
  - 3. Average Size: NSSGA No. R-5, screen opening 5 inches.
- C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone. Refer to Construction Plans.

- D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "EARTH MOVING."

#### 3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
  - 1. Install piping pitched down in direction of flow.
  - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
  - 3. Install piping with 36-inch minimum cover.
  - 4. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
  - 5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
  - 6. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

#### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
  - 1. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
  - 2. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.



3. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
4. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
5. Join dissimilar pipe materials with nonpressure-type flexible couplings.

#### 3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
  1. Use Medium-Duty, top-loading classification cleanouts in unpaved areas.
  2. Use Heavy-Duty, top-loading classification cleanouts in paved areas.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

#### 3.5 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
  1. Use Medium-Duty, top-loading classification drains in unpaved areas.
  2. Use Heavy-Duty, top-loading classification drains in paved areas.
- B. Embed drains in 4-inch minimum concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.

#### 3.6 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

#### 3.7 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet mitered slopes, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade with mitered slopes.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

3.9 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.10 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 14 13 "FACILITY STORM DRAINAGE PIPING."
- B. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
  - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
  - 3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    - a. Use concrete that will attain a minimum 28-day compressive strength of 4,000 psi unless otherwise indicated.
    - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
  - 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.



3.11 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 20 00 "EARTH MOVING." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
  - 1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    - b. Option: Test plastic piping according to ASTM F 1417.
    - c. Option: Test concrete piping according to ASTM C 924.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.13 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 33 41 00



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